

Course Title: Compilers and Languages
Date: 28.11.2015 (First term)Course Code: CCE3113 3rd year
Allowed time: 1 hrs and 30 minutesAnswer the following questions:Question No. 1

(6 marks)

1. Given the following ambiguous context free grammar

(4 marks)

$$S \rightarrow aSbS \mid aS \mid c$$

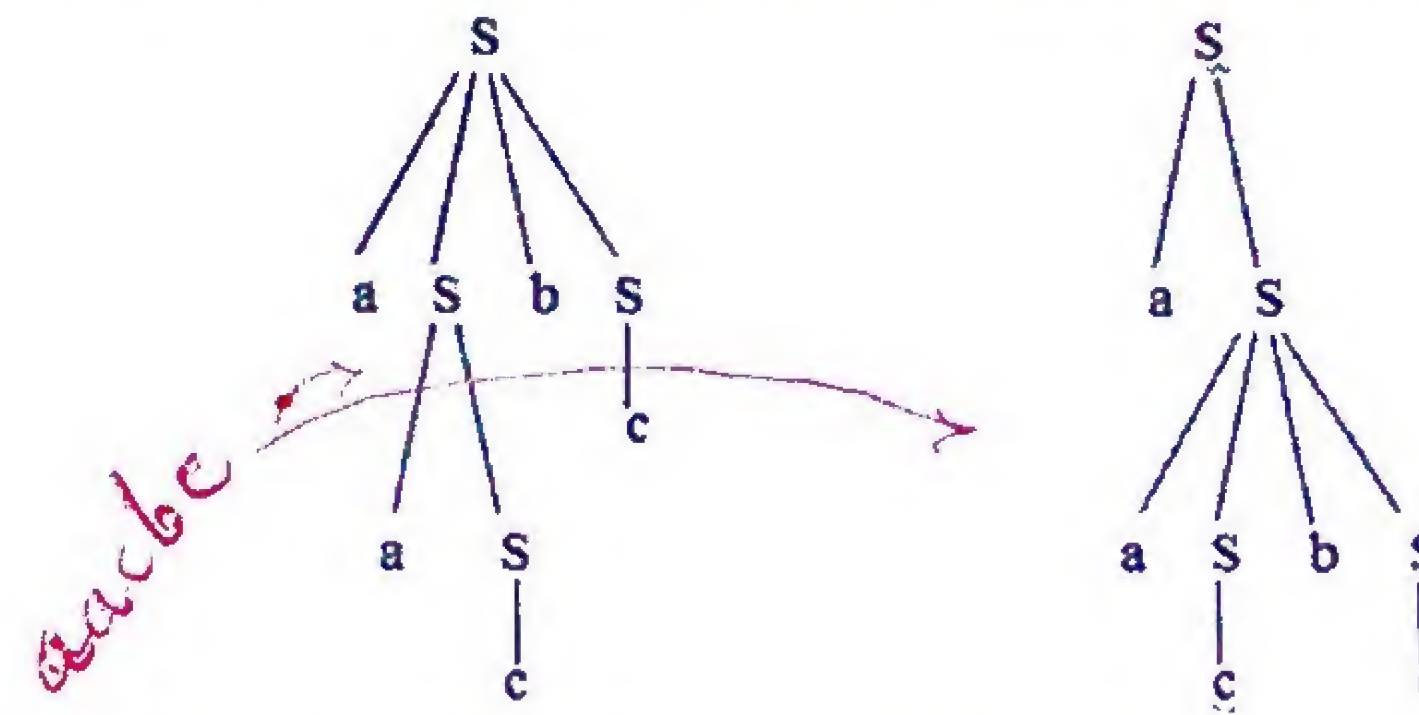
(a) Show that the string $s = aacbc$ has two leftmost derivations.The string $aacbc$ has the following two distinct leftmost derivations:

$$S \rightarrow aS \Rightarrow aaSbS \Rightarrow aacbS \Rightarrow aacbc$$

$$S \rightarrow aSbS \Rightarrow aaSbS \Rightarrow aacbS \Rightarrow aacbc$$

(b) Show the two derivation trees for the string s .

The string also has two distinct parse trees, corresponding to the two leftmost derivations.



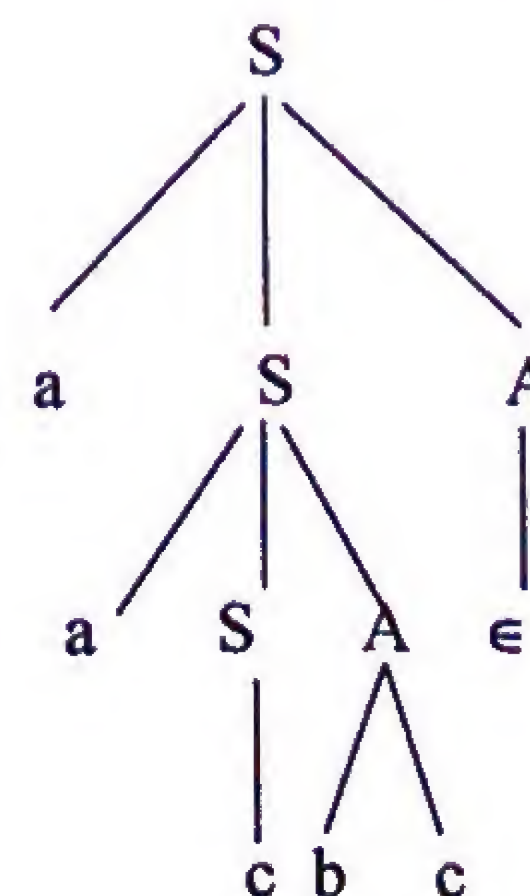
(c) Find an equivalent unambiguous context-free grammar.

$$S \rightarrow aSA \mid c$$

$$A \rightarrow bS \mid \epsilon$$

(d) Give the unique leftmost derivation and derivation tree for the string s generated from your rewritten unambiguous grammar.**The unique leftmost derivation**

$$S \rightarrow aSA \Rightarrow aaSAA \Rightarrow aacAA \Rightarrow aacbSA \Rightarrow aacbcA \Rightarrow aacbc$$

The derivation tree

$$S \rightarrow aS \mid B$$

$$B \rightarrow BbB \mid c$$

$$S \rightarrow aSbS \mid L$$

$$L \rightarrow aL \mid c$$

$$S \rightarrow aS' \mid c$$

$$S' \rightarrow SbS \mid S$$

$$S \rightarrow aS'$$

$$S' \rightarrow S'bS' \mid L$$

$$L \rightarrow aS' \mid c$$

Distinguish between derivation & Parse tree

Equivalent

c, ac, aac, ...

...?